

NON-PUBLIC?: N  
ACCESSION #: 8808170336  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Clinton Power Station PAGE: 1 of 6

DOCKET NUMBER: 05000461

TITLE: Random Failure of a Condenser Pit High Water Level Switch Results in Shutdown of Circulating Water Pumps, Loss of Condenser Vacuum and Manual Reactor Scram

EVENT DATE: 07/12/88 LER #: 88-019-00 REPORT DATE: 08/11/88

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: R. F. Schaller, Assistant Manager, Plant Operations

TELEPHONE #: 217-935-8881 Ext. 3205

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: WK COMPONENT: LS MANUFACTURER: D107

REPORTABLE TO NPRDS: N

CAUSE: X SYSTEM: SB COMPONENT: FI MANUFACTURER: T068

REPORTABLE TO NPRDS: N

ABSTRACT: On July 12, 1988, with the plant at 100% reactor power, all three circulating water (CW) pumps automatically shut down causing a rapid loss of condenser vacuum. Operators attempted to restart two of the pumps but were unsuccessful. A manual scram was initiated and the main turbine was manually tripped. A Group 1 containment isolation occurred because of low condenser vacuum. Groups 2, 3 and 20 containment isolations occurred because of low reactor water level. The safety relief valve (SRV) monitoring trouble alarm did not annunciate when one SRV was open. The root cause of this event is attributed to the random failure of a condenser pit high water level switch. Investigation identified that this switch tripped when its internal switch arm failed. Another condenser pit high water level switch was already in a tripped condition because of a bent plunger. The combination of the two tripped switches resulted in the shutdown of the CW pumps. Stress fractures resulting from corrosion caused the internal switch arm of the switch to fail to the tripped condition. Corrective action included replacing the switch that had broken internals and straightening the bent plunger. Illinois Power is evaluating other recommendations that may reduce or eliminate the

recurrence of a similar CW pump shutdown.

(End of Abstract)

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#### DESCRIPTION OF EVENT

On July 12, 1988, at approximately 0500 hours, with the plant in Mode 1 (POWER OPERATION), at 100% reactor (RCT) power, a manual reactor scram was initiated after all three circulating water (CW) system (KE) pumps (P) automatically shut down.

At approximately 0500 hours an "Auto Pump Trip" alarm (ALM) annunciated in the control room. Within nineteen seconds after the alarm annunciated, the "B" Control Room Operator (CRO) identified that the three CW pumps had shut down. While the CRO was attempting to restart two of the three pumps, the Line Assistant Shift Supervisor (LASS) ordered a reduction in power using reactor recirculation (RR) system (AD) flow. A rapid loss of condenser (COND) vacuum occurred because of the shutdown of the CW pumps. When the restart of the CW pumps was unsuccessful, the LASS ordered initiation of a manual reactor scram. The "A" CRO initiated the scram by placing the reactor mode switch (HS) in the "Shutdown" position. After the scram was verified, the LASS directed that the main turbine (TRB) be manually shut down prior to reaching its low vacuum trip. All of the above actions were taken within forty-nine seconds of the trip of the CW pumps.

Concurrent with the above operator actions, the two turbine-driven (TRB) reactor feedwater (SJ) pumps (TDRFP) tripped on low condenser (COND) vacuum and the motor-driven (MO) reactor feedwater pump (MDRFP) automatically started. In response to the TDRFP trips and to a decrease in reactor water level to Level 4 (approximately + 31 inches), the RR flow control valves (FCV) ran back to minimum position. The RR pumps tripped from fast speed and picked up in slow speed as reactor water level decreased to the Level 3 (approximately + 9 inches) low reactor water level trip. These equipment responses occurred as designed.

Reactor water level decreased approximately 29 more inches then turned upward (before reaching Level 2, approximately - 45 inches). After the main turbine was manually tripped at 0510 hours, control of the reactor water level was established using the MDRFP on the Startup Level Controller (FIK). The turbine bypass valves (V) opened to control reactor pressure. The main generator (GEN) automatically tripped.

When the Shift Supervisor (SS) noted that condenser vacuum was at

approximately -21 inches of mercury, he continued automatic reactor pressure control using the turbine bypass valves. The SS selected this method of pressure control versus alternate pressure control methods because it takes advantage of the heat capacity of the condenser metal and entrapped circulating water.

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At approximately 0540 hours, low condenser vacuum caused a Group 1 containment isolation (JM) which eliminated using the condenser as a means of pressure and level control. The Continuous Containment Purge System (VA) was then shut down and Standby Gas Treatment (BH) System train "B" was started.

At approximately 0545 hours, operators began using safety relief valves (SRVs) and the Reactor Core Isolation Cooling (RCIC) system (BN) to control reactor pressure and level. Loop "A" of the Residual Heat Removal (RHR) system (BO) was started in Suppression Pool Cooling mode with pump "A" of Shutdown Service Water (BI) system running. Operators began cycling the SRVs to control reactor pressure at 960 pounds per square inch gauge (psig) in accordance with the Level Control Emergency Operating Procedure and the Reactor Scram Off-Normal Procedure. A total of twelve SRVs were manually cycled one at a time to minimize localized heating of the suppression pool. Each time each SRV was cycled, reactor water level swelled to the Level 8 (approximately +52 inches) high water level trip for RCIC shutdown. The RCIC shut down approximately every two minutes, and after each shutdown a restart was required. After approximately fifteen minutes of tripping and restarting RCIC, the pressure control band was expanded to 800 psig. The expanded pressure control band provided approximately five minutes between Level 8 swells. SRV cycling was continued until the decay heat removal rate could be handled by the steam line drain flow to the condenser.

In an effort to identify the immediate cause of the CW pumps trips, the Staff Assistant Shift Supervisor was assigned to research drawings with Control and Instrumentation technicians, and non-licensed operators (NLO) were assigned to perform field inspections. Drawing review determined the immediate cause of the pump trips to be a false condenser pit high water level trip signal. The false signal was confirmed by troubleshooting. At approximately 0610 hours, the SS verbally directed that lead wires be lifted to defeat the false high level signal so that CW flow could be restored to enable condenser temperature to be lowered. The condenser could then be restored as a heat sink. CW pump "B" was then restarted and was used to cool down the condenser, first on the "A" water box, and then on both water boxes.

At approximately 0625 hours, Loop "B" of the RHR system was placed in the suppression pool cooling mode with pump "B" of the Shutdown Service Water system running.

At approximately 0730 hours, Suppression Pool level was identified to be higher than the limits provided in Technical Specification 3.5.3; however, the level was returned to acceptable limits within one hour as required by Action "c" of this specification.

The RCIC system was secured at 1006 hours. The SGTS was secured at 1030 hours. RHR "A" was secured from suppression pool cooling at 1110 hours. RHR "B" was secured from suppression pool cooling at 1300 hours. The "A" and "B" shutdown service water pumps were secured at approximately 1340 hours.

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In addition to the Group 1 containment isolation previously described, Groups 2, 3 and 20 containment isolations occurred. These additional isolations occurred at approximately 0501 hours because of the Level 3 low reactor water level trip.

During SRV cycling, the SRV monitoring (FI) trouble alarm did not annunciate when valve 1B21F051G was open and only three of ten indicators for the SRV acoustic monitor illuminated when the valve was open. All ten indicators on the acoustic monitor should illuminate when there is flow through the SRV. Maintenance Work Request C57001 has been initiated to troubleshoot and correct this deficiency as necessary.

A peak condensate temperature of 195 degrees Fahrenheit (F) with no CW flow was noted during this event. The NLO who restarted the CW flow noted loud creaking noises when the 83 degrees F lake cooling water entered the condenser water boxes. Prior to the plant being restarted, an evaluation was performed to determine if any damage could have occurred to the condenser. It was determined that no damage occurred.

During this event, the condensate polishers (SF) were not bypassed until reaching 190 degrees F, causing concern that the resin may have deteriorated. A chemical analysis and a consultation with the resin vendor after the event determined that the resin experienced some minor loss of life expectancy as a result of this event.

Following the event, the Radiation Protection and Chemistry departments reported no abnormal readings, indicating that no fuel damage occurred during this event.

No other automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. No other equipment or components were inoperable at the start of this event such that their inoperable condition contributed to this event.

## CAUSE OF EVENT

The root cause of this event is attributed to the random failure of condenser pit high water level switch (LS) 1LSTF002B.

An investigation of the false condenser pit high level trip signal identified that condenser pit high water level switch, 1LSTF002B, tripped when its internal switch arm failed. Another condenser pit high water level switch, 1LSTF002C, was already tripped because its plunger was bent and holding the switch in the tripped condition. These two level switch trips combined to complete the two-out-of-three condenser pit high water level trip logic required for shutdown of the CW pumps.

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The bend in the level switch plunger is believed to have occurred during previous plant maintenance when personnel unknowingly and inadvertently bent the plunger while working in the area of the switch.

The cause of the internal switch arm failure in level switch 1LSTF002B is attributed to stress fractures resulting from corrosion. The failure of this switch, at approximately 0459 hours on July 12, resulted in the CW pump shutdown.

The lack of indication of CW pump trip circuit status is considered to be a contributing cause of this event. No indications are available to provide operators with the knowledge that a switch in the two-out-of-three pump trip logic is in a tripped state. If operators are aware that a switch is tripped, they can correct the condition before a second switch trips and completes the pump trip logic.

These condenser pit high water level switches are located in a high radiation area and are not examined regularly while the plant is at power; however, an eighteen-month preventive maintenance activity verifies proper switch operation. The last verification of proper switch operation prior to this event was performed in June and July of 1987 for all three switches.

## CORRECTIVE ACTION

Level switch 1LSTF002B was replaced and the new switch was satisfactorily calibrated. The bent level switch plunger on 1LSTF002C was straightened and the switch was satisfactorily calibrated.

Similar level switches provide a high water level alarm at a lower condenser pit level, but these switches were found to be in good working order. One

additional switch was disassembled and examined for the presence of corrosion. No corrosion was found.

Since 1LSTF002B failed because of corrosion, Illinois Power (IP) is considering the replacement of the other condenser pit level switches with new switches. A decision on the replacement will be made by September 30, 1988.

IP is evaluating recommendations that may reduce or eliminate the recurrence of a similar CW pump shutdown. These recommendations include adding switch status indication, adding PM activities that would periodically test the trip actuation by cycling the switches, providing a means to protect the switches from incidental damage, and eliminating the condenser pit high water level trip for the CW pumps. This evaluation is expected to be completed by September 30, 1988.

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#### ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(iv) due to the manual actuation of the Reactor Protection System (JC).

Assessment of the safety consequences and implications of this event indicates that this event was not safety significant. Prompt and correct operator action was taken by manually scrambling the reactor before an automatic scram occurred. All subsequent equipment responses to the transient that followed the scram occurred as designed, or were manually initiated by operator action prior to their automatic initiation.

This transient was compared to similar transients described in the Final Safety Analysis Report and the Transient Safety Analysis Design Report GEZ-7355, and was found to be within the design basis of the Plant.

Review of this event indicates that condenser pit high water level switch 1LSTF002C was inoperable from some time after June/July 1987 until it was repaired and calibrated at 2200 hours on July 12, 1988. Switch 1LSTF002B was repaired and calibrated at 2200 hours on July 12, 1988.

#### ADDITIONAL INFORMATION

The condenser pit level switches are model number 710-F15-D1-ML2-N6-12 inches manufactured by Delta Controls Corporation. These level switches are commercial grade items installed in non-safety-related applications.

The SRV acoustic monitor is an accelerometer that provides indication of a

flow through the SRV. This monitor is a Model number 914 manufactured by Technology for Energy Corporation.

No previous reactor scrams have occurred as a result of the same root cause.

For further information regarding this event, contact R. F. Schaller,  
Assistant Manager - Plant Operations at (217) 935-8881, extension 3205.

ATTACHMENT # 1 TO ANO # 8808170336 PAGE: 1 of 1

U-601248  
L45-88(08-11)-LP  
2C.220

ILLINOIS POWER COMPANY  
CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727

August 11, 1988

10CFR50.73

Docket No. 50-461

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555

Subject: Clinton Power Station - Unit 1  
Licensee Event Report No. 88-019-00

Dear Sir:

Please find enclosed Licensee Event Report No. 88-019-00: Random Failure of a Condenser Pit High Water Level Switch Results in Shutdown of Circulating Water Pumps, Loss of Condenser Vacuum and Manual Reactor Scram. This report is being submitted in accordance with the requirements of 10CFR50.73.

Sincerely yours,

/s/ D. L. HOLTZSCHER  
D. L. Holtzscher  
Acting Manager - Licensing and  
Safety

RSF/ckc

Enclosure

cc: NRC Resident Office  
NRC Region III, Regional Administrator  
INPO Records Center  
Illinois Department of Nuclear Safety  
NRC Clinton Licensing Project Manager

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